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TUMOR OF THE BRAIN (THALAMUS AND INTERNAL CAPSULE).

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DR. G——, aged forty-two, who had led from boyhood a very active and responsible life, and who had been for nineteen years carrying on a laborious practice in the western part of Maryland, came to Washington, in November last, for advice and treatment.

The following account is condensed from his letters to his friend Dr. W. K. Butler, of Washington, and subsequent examinations by Dr. Butler, Dr. D. W. Prentiss, and myself.

He had usually been healthy, with the exception of typho-malaria in 1867, and of sick headaches. There was no constitutional infection of any kind. He used no stimulants or tobacco.

In the spring of 1889 he "went to pieces fast," had an attack of nearly complete suppression of the urine, with albuminuria and swelling of the legs, which symptoms, with the exception of the first, apparently lasted for some time, but disappeared during the summer.

The exact date at which the symptoms connected with

his last illness began cannot be exactly determined, and was perhaps unknown even to himself.

It was probably, however, in June. At this time his right side began to "feel asleep." He describes it afterward as "heavy as lead, with loss of feeling almost general from crown of head to sole of foot;" his "face felt like a piece of leather."

The right side was worse when the weather was cold, and was relieved by heat. He found "no feeling or contraction of muscles" on the affected side from magneto-electricity, although very marked on the left.

He speaks elsewhere of "numbness all over the body, but worse on the right;" but also, again, of "hyperæsthesia of the rest of the body," or "nervous tension." These feelings are aggravated by brain-work or excitement, and are often so trying as almost to prevent him from carrying on a conversation, but when quiet or alone are less annoying.

He suffered from headache and "dulness of the mental faculties," and an indescribable feeling of helplessness; but it is fair to say that his letters during this period are clear and correct in spelling, grammar, and choice of words, and, with the exception of frequent expressions of fatigue, might have applied to another person. The handwriting is clear, even, and without tremor.

No choreic movements were at any time noticed. There was at times forgetfulness of the names of persons and things, but apparently not sufficient to be called amnesic aphasia of a typical kind.

Some weakness of the right side appeared, which was more noticeable to himself than to any one else.

Diplopia, or "difficulty of focussing his eyes," was noted. It was worse when he was fatigued, and relieved, like some of the other symptoms, by rest, a full meal, or a dose of sulphate of magnesia.

He had one or two attacks of nearly complete unconsciousness.

Some time in September or October he had severe pain

in the stomach after eating, which continued at intervals up to the time of his coming to Washington. Gastritis was suspected.

On November 19th the patient was sleeping heavily, so that he could not be roused. He had been vomiting so persistently for some days as to lead to the suspicion of organic disease of the stomach.

Examinations made after he had returned to consciousness showed his manner to be sluggish and dull, but no delirium. He recognized persons, answered questions intelligently but slowly, and as if fatigued by the labor of thinking as well as of talking.

He said his head ached, but he was not much inclined to complain of it unless questioned.

There was a slight but distinct right facial paralysis, involving the muscles of the angle of the mouth rather than those of the eyelids. No paralyses of the muscles of the eyeball.

His handwriting at this time, in marked contrast to that of the letters, was uneven, irregular as to the direction of the lines and the size and shape of the letters, with some tremor or, rather, uncertainty of aim, and executed with hesitation and difficulty; but there was no misspelling.

He could perform all movements asked for with hand or foot, could stand on either foot, and stand with eyes shut. Whether sitting or lying he used either hand indifferently for any desired movement, and apparently alike.

There was, however, loss of power on the right. Deep reflexes normal.

The mental condition did not permit a careful examination in regard to tactile sensibility, but there was certainly decided anæsthesia on the right, but not complete.

The field of vision could not be determined, but the vision appeared good, and was certainly not sufficiently impaired to excite his remark. There was no optic neuritis. The pupils were equal, and reacted to light and to atropine readily.

From this time until his death there were several attacks of deep somnolence from which he could not be roused, in which his pulse became very rapid and feeble, and his general condition alarming.

During these it was distinctly noticed that such voluntary movements as were made were executed almost entirely by the left side.

In other words, when he was in the somnolent condition the hemiparesis, which at other times was hardly, if at all, perceptible, became very well marked.

He lost flesh and strength, and began to pass urine and faeces in bed, even after he was able to make a coherent but short and sluggish reply to a question. Hiccough was a very annoying and exhausting symptom for two or three weeks before death. It had been present before he came to Washington for a considerable time. Constipation was marked most of the time, and occasionally the symptoms seemed to improve when it was relieved; but at other times restoration from the somnolent condition took place without any movement of the bowels having preceded it. The urine was examined with unimportant results. The treatment consisted in iodide of potassium in increasing doses, and for a few days bichloride of mercury. He died on December 13th.

The autopsy, three hours after death, was confined to the head alone. The surface of the brain was dry and the convolutions flattened, especially upon the left side. There was an excess of serum in the right lateral ventricle, but nothing else abnormal was found until a section, carried through the left thalamus, disclosed a pinkish tumor of rather soft consistency. The left hemisphere was placed in alcohol, and the tumor more thoroughly examined after hardening. On the ventricular surface the thalamus appeared simply enlarged and prominent, and to have pushed the nucleus caudatus slightly forward. On section, perpendicular to the ventricular surface, a thin layer of homogeneous, somewhat dense, gray matter (thickened ependyma) covered the rather friable brownish

tumor. In the portion near the ventricle were a few small cysts containing fluid. Nearly the whole thalamus, except a small portion anteriorly and superiorly, was involved in the morbid growth. Its dimensions were : longitudinal, 5.7 ctm. ; lateral, 2.5 ctm. ; vertical, 5.0 ctm.



Horizontal Section through Basal Ganglia ; corresponding to Dalton's Series B, Plate VII.

Posteriorly and inferiorly the tumor was bounded by the corresponding horn of the ventricle. It compressed a little, but did not involve, the hippocampus. Anteriorly there was no distinct line of demarcation, though the transition from the diseased tissue to the normal was not a wide one. Above and anteriorly there was a little normal thalamus left. The tumor seemed to involve the

posterior part of the posterior limb of the internal capsule. Externally it reached within half a centimetre, more or less, of the cortex, and was bounded by a moderately distinct line of demarcation, but no capsule. The corpora quadrigemina were unaffected. The external corpus geniculatum was not identified, but the internal was closely underlaid by the morbid structure, although itself perhaps not actually encroached upon.

Sections of the tumor made and examined by Dr. W. M. Gray, the skilful microscopist of the Army Medical Museum, show that it is in reality a glio-sarcoma.

It will be seen that the salient points in this case were not numerous, but sufficiently distinct to justify a probable diagnosis of a tumor of the left brain, occupying a region either anterior to or behind the motor region, and probably the latter. Tumors situated so definitely and almost exclusively as this in the thalamus, and having so nearly destroyed it, are not common. Sometimes from their small size they cause only slight symptoms (and occasionally none at all sufficient to attract attention), but more frequently before death occurs they have invaded neighboring ganglia to an extent which diminishes their conclusiveness as physiological data.

The case here detailed has a tendency to show that the functions of the thalamus itself, the surrounding parts being comparatively unaffected, are not of such a character that their loss produces very obvious symptoms. In this case they are such that, with our present knowledge of the internal capsule, we are warranted in ascribing them rather to the limited lesion of this great conducting path ("sensory crossway") than to the ganglionic lesion. The most marked function, on the other hand, which is sometimes assigned to the thalamus, namely, that of being very closely connected in some way with vision, was, so far as could be judged, very slightly, if at all, interfered with, and was certainly not destroyed, or at all nearly so. The lesion, however, must have come very near to the part of the capsule where it would interrupt the fibres

coming from the visual centres in the occipital lobe, but evidently had not actually done so.

The earliest, most distinct, characteristic, and most persistent phenomenon was the numbness, heaviness, and anæsthesia of the right side, and is fairly attributable to the involvement of the posterior part of the capsule.

The right hemiparesis, usually completely unnoticeable, or, at most, betraying itself only by slight traces in the face, but becoming very well marked during the somnolent condition, is probably to be connected with the varying conditions of pressure upon the anterior part of the capsule owing to the differing conditions of the circulation. This intermittency has been noted in other cases of tumor in this region.

The relations of the thalamus to vision are certainly not easy to make out, so far as cases of tumor go. In some, as well as in this, vision is distinctly stated to be entirely unimpaired, while in others hemianopia is noted. In others, still, we must infer the absence of hemianopia from the completeness of the report and the thoroughness of the observer.

It is to be regretted that a more careful examination in this direction could not have been made in our case before the mental faculties became too clouded; but it is certainly fair to suppose that at a time when the patient was able to notice diplopia and "inability to focus the eyes," and to observe the connection of this symptom with his general condition of fatigue, and also to note and describe the pulse, temperature, and tongue of a patient (October 14th), such a symptom as hemianopia or marked amblyopia could not have been entirely unnoticed.

Of the three most important general symptoms of cerebral tumor—headache, vomiting, and optic neuritis—only the first two were present.

Somnolence is likely to be an important symptom in tumors of the thalamus, since in this region, from its central situation, any enlargement produces a general and equable pressure in every direction. It may also easily

happen that from the encroachment of the tumor on the aqueduct of Sylvius (iter à tertio, etc.) the accumulation of fluid will add to the generally diffused pressure. This, however, had apparently not taken place to any considerable extent in this case, although there was some excess of serum in the right ventricle.

The following cases, from among a much larger number examined by the aid of the "Index Catalogue of the Surgeon-General's Library," resemble this here reported with sufficient accuracy to make them valuable for comparison. It is well known that observations of tumors limited, or nearly so, to the thalamus are not numerous.

They are introduced partly to show some other points of resemblance, but chiefly in reference to the question of the connection of the thalamus with vision.

Several others of a positive character, *i.e.*, where hemianopsia or crossed amblyopia was known to exist with a lesion of the posterior third of the thalamus, might have been added and may be found in Nothnagel;¹ but there are very few which show this coincidence in which it is clear that nothing beside the thalamus was involved. Nothnagel admits only two as conclusive; one by Remy, of crossed amblyopia (so reported, although it is thought possible by Nothnagel that it was really hemianopia), where the lesion was an old clot in the postero-supero-external portion of the thalamus; and the other by Hughlings Jackson, of well-determined hemianopia, with a lesion which is very distinctly defined as not going beyond the thalamus.

On the other hand, there are a number where the posterior extremity was involved where vision is stated to have been good. Nothnagel says (1879) that disturbances of vision "can" exist with a lesion of the posterior third of the thalamus. Gowers,² nine years later, uses the words "may cause," but says, a line or two further on, that "hence we must regard the pulvinar as the intermediate visual centre."

¹ Die topische Diagnose der Hirnkrankheiten.

² Diseases of Nervous System.

I have not been able, among the cases published since, to find any which will bear such a criticism as Nothnagel subjects the earlier ones to, sufficiently well to justify the stronger expression of Gowers. It is certainly difficult to see how visual messages could have been transmitted through a way-station so hopelessly disorganized as the thalamus was in many of the cases to be reported, or in this one just described, sufficiently well for neither the patient nor such observers as Ferrier and Nothnagel to be aware that something was the matter with vision.

The first two cases, those of Webber and of Bruzelius and Blixt, are apparently somewhat in favor of the connection of thalamic disease and defect of vision; but the conclusiveness of the first is destroyed by the explanation of the sensory and motor phenomena given by the reporter himself, while the second is lacking in a clinical point of view. At the most, their value is better expressed by "may" or "can" than by "must."

CASE I.—Webber:¹ Headache, attacks of unconsciousness (brief), right hemiplegia, right hemianopsia, right hemianæsthesia, with hyperalgesia, disturbance of speech, left amblyopia, tumor in region of optic thalami and corpora quadrigemina.

The posterior inferior part of the right optic thalamus, in the immediate neighborhood of the corpora quadrigemina, was occupied by a nodule about the size of a filbert meat, of a red color, and rather soft consistency. The anterior corpus quadrigeminum was probably indicated. What was supposed to be the left optic thalamus was occupied through its whole middle and posterior portion by a soft red mass, like that seen in the right thalamus, and which was probably continuous with the latter. Altogether the mass must have been the size of a small plum.

Dr. Webber says the disturbance of sensation and the partial loss of motor power were probably caused by pressure of the tumor upon the posterior part of the internal capsule. Why not also the hemianopia?

¹ Boston Medical and Surgical Journal, September 20, 1888.

CASE II.—Bruzelius and Blixt.¹ Headache, weak-mindedness, formication in extremities, double vision, weakness in left (?) extremities, slight facial paralysis on the right side. Improvement with iodide. Sudden death. Hearing and vision diminished. Hen's egg tumor starting from left optic thalamus; ventricles distended with clear fluid.

CASE III.—Hjelt.² A cholesteatoma the size of a hen's egg took in the whole of the left optic thalamus and stretched the horn of the left lateral ventricle and surrounded the choroid plexus. There were no symptoms. The patient died of cancer of the stomach.

CASE IV.—Nicaise.³ Woman, aged forty-eight. Headache left side, vomiting. Motility and sensibility intact. No trouble of vision, audition, or smell. A little incoherence, then delirium, coma, involuntary micturition and defecation. Convulsions more marked on the left side of the face. Ellipsoid tumor of the whole optic thalamus and corpus striatum of the left side, which were "totally" invaded.

CASE V.—Ogle.⁴ Girl, aged nineteen. Complained two or three days of sickness and headache. Drowsiness, no delirium or paralysis or alteration of pupils. Nothing said of vision. Died comatose. Left optic thalamus three times its usual size, encroaching greatly on right lateral ventricle; septum pushed forward, right thalamus pressed upon; other optic thalamus softer than natural, but nothing more.

CASE VI.—Kerschensteiner.⁵ Teacher, aged twenty-five. Severe headache; later vomiting. Senses completely unaffected. Pupils react, although sluggishly; cannot bear long looking at light. Some paralysis of left cheek muscles, but no other hemiplegia. The right ven-

¹ Nordiskt Med. Arch., III.

² Schmidt's Jahrbücher, 155, p. 150.

³ Bull. Soc. Anat., Paris, 1874, p. 559.

⁴ Path. Trans., Lond., 1855-56, vii., p. 12.

⁵ Aertz. Intell. Bl., 1869, xvi., p. 295.

tricle contained four ounces of serum. A growth (soft, vascular glioma) had taken the place of the right thalamus; it was very difficult to separate from the brain substance, especially at the outer border.

CASE VII.—Nothnagel.¹ Boy, aged thirteen. The face on the right side moved but little during any emotional manifestation, but at rest or for voluntary movements the paralysis was less marked. Diminution of sensation and motion on left. Gait staggering. The field of vision was not examined, but the patient could see, although the movements of the eyeball were somewhat restricted and he had choked disks. There was hydrocephalus internus and a glioma of the right optic thalamus, the lateral and posterior portions in particular being enormously enlarged; a portion arched over the left anterior corpus quadrigeminum.

CASE VIII.—Ferrier.² Fall on the ice four years before. Fits, diplopia, reeling in gait, left leg used with difficulty, left arm unsteady. Ocular movements affected; double optic neuritis; superficial reflexes on both sides, but better on right. Tactile sensibility somewhat defective on whole left side, but painful impressions are felt and correctly localized. Sight good, taste and smell good, hearing better on right. Sopor, mental hebetude, increasing paralysis left side, anæsthesia and analgesia, fits; right pupil insensible to light, left reacted slightly. Right optic thalamus and right side of corpora quadrigemina, while retaining their normal shape and surface, larger than left. Ant. post. diam. opt. thal., R., 2; L., $1\frac{1}{2}$; width, R., 2; L., $\frac{3}{4}$. Right ant. tuberc. quadrigem. one-fourth larger in all dimensions than left. Internal capsule and ganglionic structure of right thal. and limbic nucleus were indistinguishable; subthalamic region and tegmentum of crus cerebri seemed involved in growth. Foot of crus and locus niger distinct; nucleus caudatus,

¹ Wiener Med. Blatter, 1889, p. 755.

² Brain, London, v., 123.

internal capsule, and anterior part of lenticular nucleus were of normal appearance. The thalamus pressed backward against anterior lobe of right side of cerebellum and was closely appressed and moulded against this and middle peduncle. (A diagnosis of tumor affecting right side of cerebellum and pons had been made.) A discrepancy will be noticed between two statements as to the condition of the internal capsule. They probably refer to those portions of the capsule in immediate contiguity with the other structures mentioned with them.

CASE IX.—Assagioli and Bonvecchiato.¹ A female, aged fifteen. Choreic movements of right face and extremities of right side, later right hemiplegia, right blepharospasm. No disturbance of vision. Later aphasic condition. Intelligence disturbed at the last. No large quantity of serum in the ventricles. Thalamus (left) double the normal size, changed to a pink gliomatous mass, very soft. Nothing of thalamus remaining except a fine peripheral layer. All other parts of the brain healthy.

¹ Rivista speriment. di Fren., 1878, p. 362.